Distribution of the Blood Groups of the Norwegian Lapps

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ABSTRACT Blood groups have been determined in samples from 423 Norwegian Lapps. The findings in the ABO, MNSs, P, Rh, Lewis, Duffy and Kidd systems are presented and compared with previous observations in various Lapp populations. Rather marked differences were observed between Lapps living in different geographical locations.

The Lapps are a small group of people living in the northern part of the Fenno-Scandian peninsula and the adjacent districts of Russia. The origin of the Lapps remains a mystery. As a racial group they are characterized by low stature, high cephalic index, and dark hair and eye colors. Variations in these characteristics between different Lappish subgroups are, however, demonstrable (Beckman, '65). The Lapps also show a very low incidence of a patent medio-frontal suture (Torgersen, '56).

Before 1950 only limited data were available on the ABO and MN groups of the Lapps. The studies of Norwegian and Swedish Lapps by Allison and his coworkers ('52, '56) revealed an extraordinary distribution in a number of blood group systems. Later some additional reports appeared on the Swedish (Beckman, '59), Finnish (Melartin, '64) and Skolt Lapps (Eriksson, '68; Eriksson et al., '67). The more striking findings such as the high frequencies of the A_2 and $D(Rh_0)$ properties were present in all these studies. However, there were also some discrepancies between the findings in the Norwegian Lapps and those in the other groups of Lapps. It therefore seemed highly desirable to examine to what extent these discrepancies demonstrate anthropological differences and to what extent they can be explained by technical factors.

Even though the study of Allison et al. ('52) of the Norwegian Lapps comprised all the blood group systems known at that time, the number of people examined (183 persons) was relatively small. Study of a larger series might permit a comparison of the different sub-communities of Lapps in Northern Norway. Antisera defining some additional blood factors have also become available. Studies of these "new" properties might give some clue as to the origin and racial affinities of the Lapps.

For these reasons the blood groups of an additional number of Norwegian Lapps have been examined.

MATERIAL

The present blood samples were collected by the author in August-September, 1959. All the Lapps examined lived in Finnmark, the most northern county of Norway. The majority of the samples were obtained from school-children aged 10 to 16 years. Several samples were also drawn from people living in homes for the elderly and sick. Only a minor number came from non-institutionalized adults.

In principle, only pure Lapps were examined, persons with ancestors of known non-Lappish origin being excluded. The information given by the subjects was sometimes questionable. However, valuable assistance was given by the schoolmasters and others having a close knowledge of the local population who helped select the persons to be examined. Lappish was the main language of all these people.

Although we attempted to avoid examining several members of the same family,

this was difficult to accomplish. The family names were of little or no help; in some areas a few names were used by a number of families without any known relationship. In other areas the original Lapp family names had recently been replaced by the Lapp or Norwegian names of local farms.

A total of 423 putatively pure Lapps were examined. In addition, ten samples from persons with some known non-Lappish admixture were included when testing for the rare Di^a and Wr^a blood group antigens.

The material was divided into four groups according to the place of birth, or, when this information was not available, according to the residence of the family. Three of the groups represent geographically distinct locations, viz. the Karasjok-Grensen area (183 persons), the Kautokeino-Masi area (143 persons), and the Polmak-Sirma area (51 persons). The fourth group (46 persons) comprise the Lapps living outside the three specified districts. Most of them came from the coastal districts of eastern Finnmark, particularly Nesseby, Tana, and Lebesby.

METHODS

The blood samples were drawn in vacuum venules without any additives and sent by air mail to Oslo. They were in good condition when they arrived in the laboratory, usually two to four days after they were collected. They were examined immediately after arrival.

The specimens were tested for blood group antigens in the following systems: ABO (using the antisera anti-A, anti-B, a potent "naturally occurring" anti-A_1 from an A_2B person, and a human anti-H); MNSs (rabbit anti-M and anti-N, human anti-S); P (human anti-P_1); Rh (anti-C, -C^w, -c, -D, and -E); because of scarce supplies of anti-e, this antiserum was only used for the bloods giving the reactions C− C^w − c+ D+ E+ to differentiate between the two most probable genotypes, cDE/cde (R_2r) and cDE/cDE (R_2R_2); Kell (anti-K); Lewis (anti-Le^a, anti-Le^b, and a potent combined anti-(Le^a + Le^b), all of human origin); Duffy (anti-Fy^a); Kidd (anti-Jk^a, anti-Jk^b); Diego (anti-Di^a); and Wright (anti-Wr^a). As positive control cells we preferably used cells heterozygous for the antigen in question. Negative controls were also always included.

Because of a limited supply of serum, only 359 samples were tested for the S antigen. In the P system all persons belonging to the blood groups B and AB were omitted from the series, as an unabsorbed serum originating from a group A person was used. In the Lewis system only observations on O and A_2 cells will be presented, as the reactions which the anti-Le^b gave with A_1 cells were weaker and not quite reliable. In the other blood group systems, all the 423 samples obtained were tested.

Calculation of gene frequencies. The gene frequencies of the A_1A_2BO system were calculated using Bernstein's corrections, as cited by Mourant ('54).

In the MNS system the computations were performed according to the formulae given by Mourant ('54) for tests done with three antisera.

Several gene complexes in the Rh system, i.e., *cDe* (R_o), *cdE* (R″), *CDE* (R_z) and *CdE* (R_y), were not present in a recognizable genotype in any of the four groups. The frequencies of the remaining complexes, *CDe* (R_1), *cDE* (R_2), C^wDe (R_1^w), and *Cde* (R′), were determined by gene counting from the most probable genotypes; the *cde* (r) frequency was obtained from $\sqrt{cde/cde}$. All the values were then adjusted using Bernstein's corrections. The procedure gives a somewhat too low value for *Cde* (R′), but as the Ccddee (R′r) phenotype was found in a single person only in the present study and was absent in the previous studies of the Lapps, it seems permissible.

In the P system, the gene frequencies were calculated as: $P_2 = \sqrt{P_2}$, and $P_1 = 1 - P_2$, assuming that no *p* gene occurred in the series. Computation of the genes Fy^a and Fy^b of the Duffy system was done in the same way, similarly assuming that the *Fy* gene was not present.

In the Kidd system the frequencies of Jk^a and Jk^b were determined by gene counting.

For the Lewis system only phenotype frequencies are given.

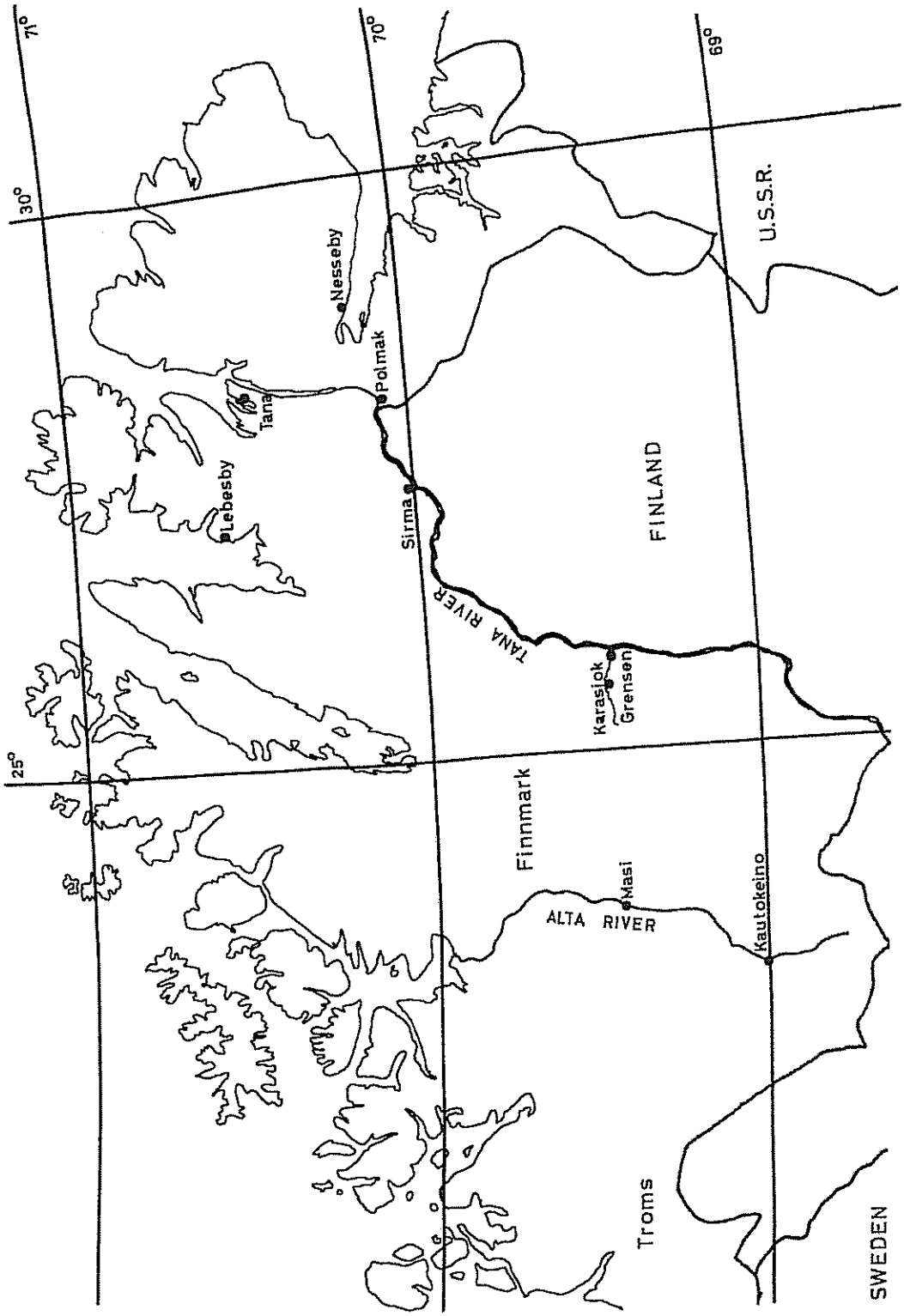

Fig. 1 Map showing the locations of the various groups of Norwegian Lapps examined.

TABLE 1

The A_1A_2BO blood groups

Phenotype		Polmak-Sirma		Karasjok-Grensen		Kautokeino-Masi		Coastal districts	
		No.	Frequency	No.	Frequency	No.	Frequency	No.	Frequency
A_1	Obs.	16	0.3137	46	0.2514	44	0.3077	15	0.3261
	Exp.	17.3	0.3399	43.3	0.2365	42.5	0.2975	13.8	0.2998
A_2	Obs.	21	0.4118	58	0.3169	30	0.2098	17	0.3696
	Exp.	20.0	0.3920	59.3	0.3239	31.7	0.2215	17.6	0.3833
B	Obs.	1	0.0196	18	0.0984	25	0.1748	4	0.0870
	Exp.	1.4	0.0281	16.3	0.0891	25.2	0.1765	3.3	0.0710
O	Obs.	11	0.2157	52	0.2842	20	0.1399	7	0.1522
	Exp.	10.7	0.2096	53.3	0.2915	19.9	0.1388	7.5	0.1632
A_1B	Obs.	2	0.0392	1	0.0055	10	0.0699	0	0.0000
	Exp.	0.6	0.0116	3.9	0.0213	11.4	0.0796	1.3	0.0289
A_2B	Obs.	0	0.0000	8	0.0437	14	0.0979	3	0.0652
	Exp.	0.9	0.0189	6.9	0.0377	12.3	0.0860	2.5	0.0536
No. examined		51		183		143		46	
Gene									
A_1		0.1947		0.1385		0.2108		0.1807	
A_2		0.3178		0.2446		0.2277		0.3353	
B		0.0297		0.0770		0.1889		0.0800	
O		0.4578		0.5399		0.3726		0.4040	

The tests in the Diego and Wright systems showed all the examined persons to be Di(a−) and Wr(a−), as previously reported (Kornstad, '60, '61). The Kell blood groups and the Gc serum groups have also been published elsewhere (Kornstad et al., '66; Reinskou and Kornstad, '65). The K frequency in the three inland groups was significantly lower than in the coastal districts. The very low K frequency in Central Finnmark seems to indicate that the *K* gene is essentially lacking in pure Lapps. In the Gc system, a Gc^1 frequency of 0.775 was found for the total series. In the Kautokeino-Masi group, however, a Gc^1 frequency of 0.719 was found, which is even lower than in the non-Lappish Norwegian population.

As the findings in the Kell and Gc systems indicated some heterogeneity in the series, separate gene frequencies were determined for each of the four groups of Lapps for the blood groups to be presented. The expected values were calculated on the basis of these frequencies, and not from the gene frequencies of the total series.

RESULTS AND DISCUSSION

The findings in the present series are given in tables 1–5. For comparison, the data of Allison et al. ('52, '56) and Beckman et al. ('59) are given in table 6.

A_1A_2BO system (table 1). The most remarkable feature of the previous studies was the extremely high frequency of the A_2 gene. In the present series the A_2 frequency is lower, particularly in Kautokeino-Masi, but also in the Karasjok-Grensen group. However, it is still very high as compared with the surrounding non-Lappish populations, and it is also somewhat higher than in the Skolt Lapps of Sevettijärvi (Eriksson et al., '67).

The A_1 frequency is close to that observed by Allison et al. in the Norwegian Lapps and distinctly higher than in the Swedish Lapps, but slightly lower than in the Skolts (Eriksson, '68).

As for the *B* gene, the Kautokeino-Masi group differs markedly from the three other groups. In Kautokeino-Masi the *B* frequency is even slightly higher than in the study of Allison et al. ('52), whereas the three other groups of Norwegian Lapps show values closer to the Swedish Lapps. A high *B* frequency has also been observed in the Skolt Lapps (Eriksson et al., '67).

The frequency of the *O* gene in the Kautokeino-Masi area is close to that observed by Allison et al. ('52), while Karasjok-Grensen shows higher values, close to those of Swedish Lapps.

TABLE 2

The MNSs blood groups

Phenotype		Polmak-Sirma		Karasjok-Grensen		Kautokeino-Masi		Coastal districts	
		No.	Frequency	No.	Frequency	No.	Frequency	No.	Frequency
MMS	Obs.	10	0.2041	42	0.2456	16	0.1553	9	0.2500
	Exp.	8.7	0.1782	43.8	0.2563	16.5	0.1608	7.9	0.2196
MMss	Obs.	6	0.1224	14	0.0819	1	0.0097	1	0.0278
	Exp.	5.6	0.1142	15.2	0.0892	1.4	0.0135	1.1	0.0303
MNS	Obs.	9	0.1837	56	0.3275	40	0.3883	10	0.2778
	Exp.	11.5	0.2327	52.3	0.3063	42.4	0.4118	12.6	0.3513
MNss	Obs.	12	0.2449	33	0.1930	12	0.1165	6	0.1667
	Exp.	12.9	0.2640	30.5	0.1783	7.7	0.0745	5.4	0.1487
NNS	Obs.	4	0.0816	12	0.0702	27	0.2621	4	0.1111
	Exp.	2.8	0.0584	13.8	0.0808	24.4	0.2370	2.5	0.0680
NNss	Obs.	8	0.1633	14	0.0819	7	0.0680	6	0.1667
	Exp.	7.5	0.1525	15.2	0.0892	10.5	0.1023	6.6	0.1821
No. examined		49		171		103		36	
Gene complex									
MS		0.2028		0.2891		0.3011		0.3258	
Ms		0.3380		0.2986		0.1164		0.1742	
NS		0.0687		0.1137		0.2626		0.0733	
Ns		0.3905		0.2986		0.3199		0.4267	

MNSs system (table 2). When the *M* and *N* genes are considered separately, the frequencies in the present series as a whole are close to the figures found by Allison et al. ('52). However, there is a difference among the various groups of Norwegian Lapps, the Kautokeino-Masi group showing distinctly lower *M* values than the Karasjok-Grensen group, which even approaches the Skolt Lapps (Eriksson et al., '67). The *M* and *N* frequencies of the Kautokeino-Masi group are, on the other hand, close to those observed in the Swedish Lapps.

As for the frequencies of *S* and *s*, the present series as a whole shows values fairly close to the previous findings in the Lapps (Allison et al., '52, '56; Eriksson, '68). However, again an intergroup variation is found in the present study, the Kautokeino-Masi group showing a remarkably high *S* frequency.

The frequencies of the MNSs gene complexes in the total present series show *NS* and *Ns* values close to those in the previous series (Allison et al., '52), but somewhat higher *MS* and lower *Ms* values. The *Ms* frequency is intermediate between the earlier findings in the Swedish and the Norwegian Lapps. More striking, however, is the variation among the four groups. In Polmak-Sirma and Karasjok-Grensen, the *Ms* frequency is appreciably higher than in Kautokeino-Masi. The latter area shows a remarkably high *NS* frequency.

Rh system (table 3). The most notable feature of the Rh groups in the previous studies was the low incidence of the *cde* (r) complex. This is even more striking for the Polmak-Sirma and Karasjok-Grensen groups of the present study. The *cde* (r) frequencies in the Kautokeino-Masi Lapps and the Swedish Lapps are rather similar.

The Norwegian and Swedish Lapps have also, by a narrow margin, the highest known frequency of C^wDe (R_1^w). In this respect the present series as a whole shows good agreement with the previous study of the Norwegian Lapps. The lack or low incidence of this gene complex in Polmak-Sirma and the coastal districts may be another example of the variation between different Lapp sub-communities. However, the Polmak-Sirma sample consists of only 51 persons. A study of a greater number from this area would be necessary to determine whether our finding is caused by chance in sampling. A potent anti-C^w serum was used in the present study.

The previous studies seemed to indicate a higher incidence of the ccDee phenotype and thus also the *cDe* (R_0) gene complex in the Norwegian Lapps than in the

TABLE 3

The Rh blood groups

Phenotype	Probable genotype		Polmak-Sirma		Karasjok-Grensen		Kautokeino-Masi		Coastal districts	
			No.	Frequency	No.	Frequency	No.	Frequency	No.	Frequency
CCDee	R_1R_1	Obs.	19	0.3725	62	0.3388	26	0.1818	16	0.3478
		Exp.	18.5	0.3619	60.9	0.3330	32.3	0.2256	16.2	0.3513
CcDE	R_1R_2	Obs.	21	0.4118	67	0.3661	38	0.2656	9	0.1957
		Exp.	17.6	0.3448	57.3	0.3129	32.5	0.2273	9.6	0.2082
CcDee	R_1r	Obs.	4	0.0784	16	0.0874	40	0.2797	11	0.2391
		Exp.	6.8	0.1338	22.9	0.1252	31.1	0.2178	11.8	0.2567
ccDEE	R_2R_2	Obs.	3	0.0588	9	0.0492	7	0.0490	1	0.0217
		Exp.	4.2	0.0821	13.5	0.0735	8.2	0.0573	1.4	0.0308
ccDEe	R_2r	Obs.	3	0.0588	10	0.0546	9	0.0629	5	0.1087
		Exp.	3.2	0.0637	10.8	0.0588	15.7	0.1097	3.6	0.0775
Ccddee	R′r	Obs.	0	0.0000	0	0.0000	0	0.0000	1	0.0217
		Exp.	0	0.0000	0	0.0000	0	0.0000	0.2	0.0049
C^wDee	$R_1^wR_1$	Obs.	0	0.0000	8	0.0437	5	0.0350	1	0.0217
		Exp.	0	0.0000	9.1	0.0495	7.7	0.0536	0.6	0.0130
C^wcDE	$R_1^wR_2$	Obs.	0	0.0000	6	0.0328	7	0.0490	0	0.0000
		Exp.	0	0.0000	4.3	0.0233	3.9	0.0270	0.2	0.0039
C^wcDee	R_1^wr	Obs.	0	0.0000	2	0.0109	4	0.0280	0	0.0000
		Exp.	0	0.0000	1.7	0.0093	3.7	0.0259	0.2	0.0049
ccddee	rr	Obs.	1	0.0196	3	0.0164	7	0.0490	2	0.0435
		Exp.	0.6	0.0124	2.2	0.0118	7.5	0.0526	2.2	0.0487
No. examined			51		183		143		46	
Gene complex										
CDe	(R_1)		0.6016		0.5771		0.4750		0.5818	
cDE	(R_2)		0.2865		0.2711		0.2393		0.1756	
Cde	(R′)		0.0000		0.0000		0.0000		0.0110	
C^wDe	(R_1^w)		0.0000		0.0429		0.0564		0.0110	
cde	(r)		0.1112		0.1085		0.2293		0.2206	

TABLE 4

The P, Duffy and Lewis blood groups

		Polmak-Sirma		Karasjok-Grensen		Kautokeino-Masi		Coastal districts	
		No. obs.	Frequency	No. obs.	Frequency	No. obs.	Frequency	No. obs.	Frequency
Phenotypes	P_1+	29	0.6042	74	0.4744	55	0.5914	16	0.4103
	P_1-	19	0.3958	82	0.5256	38	0.4086	23	0.5897
Genes	P_1		0.3708		0.2754		0.3607		0.2321
	P_2		0.6292		0.7246		0.6393		0.7679
No. examined		48		156		93		39	
Phenotypes	Fy (a+)	42	0.8235	137	0.7486	115	0.8042	40	0.8696
	Fy (a−)	9	0.1765	46	0.2514	28	0.1958	6	0.1304
Genes	Fy^a		0.5798		0.4983		0.5575		0.6389
	Fy^b		0.4202		0.5017		0.4425		0.3611
No. examined		51		183		143		46	
Phenotypes	Le (a+b−)	0	0.0000	1	0.0091	3	0.0600	0	0.0000
	Le (a−b+)	25	0.78125	94	0.8545	39	0.7800	20	0.8333
	Le (a−b−)	7	0.21875	15	0.1364	8	0.1600	4	0.1667
No. examined		32		110		50		24	

Swedish Lapps. In the present study the ccDee phenotype was not observed. The discrepancy is most likely related to the anti-C and/or the anti-E sera used in the Norwegian studies. Correspondingly, a somewhat higher incidence of the *CDe* (R_1) and *cDE* (R_2) complexes was observed in the present investigation than in the previous series of Norwegian Lapps. The *cDE* (R_2) frequency is rather high in all the three geographically distinct groups. The *CDe* (R_1) frequency in the Kautokeino-Masi area is close to that of the previous observations in Lapps, whereas this gene complex is more frequent in the Polmak-Sirma and Karasjok-Grensen districts.

P system (table 4). The earlier studies indicated that the P_1 frequency in Norwegian Lapps was comparable to that in the rest of Europe, while it appeared to be much lower in Swedish Lapps and Skolts. In the present investigation the P_1 gene is, in fact, even slightly less frequent than in the two Swedish series, and very close to the Skolts (Eriksson et al., '67). Because of the variation in the strength of positive reactions given by anti-P_1 sera, some caution is necessary in the anthropological interpretation of findings in this system.

Duffy system (table 4). A very high incidence of the Fy^a gene was observed in the Norwegian and Skolt Lapps (Allison et al., '52; Eriksson, '68), while Allison et al. ('56) found a lower incidence in the Swedish Lapps. The present findings are quite close to the latter. However, the Fy^a frequency in the present series is still clearly higher than in the non-Lappish, Norwegian population (Juel and Vogt, '58).

Lewis system. As already mentioned, only observations on O and A_2 bloods are included in table 4. The A_1 cells were, however, tested with anti-Le^a. Among the 337 group O, A_2, and A_1 persons who were tested, only nine were Le(a+), i.e., 2.67%. The incidence is appreciably lower than in the non-Lappish, Norwegian population (Brendemoen, '61; Kornstad, '69). The incidence of Le(b+) persons is slightly higher than in the Norwegian population. According to the present view on the genetical pathways for the biosynthesis of the Lewis antigens, the low frequency of the blood group Le(a+b−) should therefore be caused mostly by a low incidence of the *se* (non-secretor) gene in the Lapps. However, as the incidence of the phenotype Le(a−b−) is somewhat higher in the Lapps (15.7% of the group O and A_2 persons) than in the Norwegian population, the *Le* gene should also be slightly less frequent in the Lapps.

Kidd system (table 5). The Kidd groups of the Lapps had not been examined previously. In the Norwegian pop-

TABLE 5

The Kidd blood groups

Phenotype		Polmak-Sirma		Karasjok-Grensen		Kautokeino-Masi		Coastal districts	
		No.	Frequency	No.	Frequency	No.	Frequency	No.	Frequency
Jk (a+b−)	Obs.	15	0.2941	59	0.3224	68	0.4755	16	0.3478
	Exp.	14.3	0.2803	50.9	0.2780	63.1	0.4413	14.1	0.3072
Jk (a+b+)	Obs.	24	0.4706	75	0.4098	54	0.3776	19	0.4130
	Exp.	25.4	0.4983	91.2	0.4985	63.8	0.4460	22.7	0.4941
Jk (a−b+)	Obs.	12	0.2353	49	0.2678	21	0.1469	11	0.2391
	Exp.	11.3	0.2215	40.9	0.2234	16.1	0.1127	9.1	0.1986
No. examined		51		183		143		46	
Gene									
Jk^a		0.5294		0.5273		0.6643		0.5543	
Jk^b		0.4706		0.4727		0.3357		0.4457	

TABLE 6

The blood groups of the Norwegian and Swedish Lapps. Comparison of the present and previous studies

Genes or gene complexes	Present study Norwegian Lapps	Allison et al. ('52) Norwegian Lapps	Allison et al. ('56) Swedish Lapps		Beckman et al. ('59) Swedish Lapps
			Main series	Vittangi Lapps	
O	0.4632	0.3452	0.6107	0.5503	0.534
A_1	0.1736	0.1589	0.0451	0.0538	0.063
A_2	0.2557	0.3563	0.3233	0.3694	0.372
B	0.1074	0.1394	0.0209	0.0265	0.031
MS	0.2679	0.1881	0.2506		
Ms	0.2558	0.3283	0.1354	0.447	0.4594
NS	0.1539	0.1804	0.1965		
Ns	0.3224	0.3033	0.4175	0.552	0.5406
CDe (R_1)	0.5452	0.4712	0.4912		
C^w De (R_1^w)	0.0386	0.0389	0.0424	0.5582	0.506
CD^ue (R_1^u)	—	0.0145	—	—	0.101
cDE (R_2)	0.2515	0.1837	0.2383	0.0747	—
cDe (R_0)	—	0.1034	0.0269	0.0452	0.106
Cde (R′)	0.0012	—	—	—	0.061
cde (r)	0.1634	0.1883	0.2011	0.2919	—
P_1	0.3057	0.5325	0.3684		0.226
P_2	0.6943	0.4675	0.6316		0.386
Fy^a	0.5414	0.8189	0.5528		0.614
Fy^b	0.4586	0.1811	0.4472		

ulation, Lundevall ('56) tested a large series with anti-Jk^a and found Jk^a = 0.5061. In a smaller series, tested with anti-Jk^a and anti-Jk^b, Kornstad and Halvorsen ('58) found Jk^a = 0.52. In the present investigation the observed values for the heterozygotes were somewhat smaller than expected. This may have been caused by false-negative reactions in a few heterozygous persons, even though Jk(a+b+) cells were used as a positive control. Making some reservation for the effect of this on the estimation of the gene frequencies, the high Jk^a frequency in the Kautokeino-Masi group still seems noteworthy. In the other groups of Lapps the frequencies are fairly close to those in the Norwegian population.

COMMENTS

The studies of Allison and coworkers suggested that the Norwegian Lapps ap-

peared to be rather less "pure" racially than those living in Sweden. The study of Beckman et al. ('59), however, indicated a heterogeneity within the Swedish Lapp population. A rather marked intergroup variation is found in the present investigation of the Norwegian Lapps. While one group of Lapps shows the most "typical Lapp features" with regard to some genes, other groups are more "typical" with regard to other genes. An evaluation of the "purity" of the various groups of Lapps on the basis of the present or earlier blood group data therefore hardly seems permissible. It is difficult to know to what extent the demonstrated differences are caused by various degrees of admixture of the surrounding Finnish, Swedish and Norwegian populations, and to what extent they result from genetic drift in isolates.

Archaeological studies have revealed that people lived in the coastal districts of Finnmark about 8000 years ago (the "Komsa culture"), but it is not known whether there is any relationship between them and the Lapps. Other Stone Age findings have shown that about 4000 years ago, there lived a hunting people in the central parts of Finnmark, and also in the inland of northern Finland and Sweden. Some observations point to a link between them and the present day Lapps (Vorren and Manker, '58).

It has often been said that the Lapps show some Asiatic traits. However, they lack the Di^a blood group antigen (Beckman et al., '59; Kornstad, '60), and to the present author it seems that neither the other blood group findings nor the physical characteristics of the Lapps give any convincing support for the view. The most conspicuous physical characteristic other than blood groups which the author observed in the Norwegian Lapps was the high incidence of congenital hip dislocation. In this respect, too, the Lapps seem to be rather unique.

In view of the indications that the rather small population of Lapps has lived for a long period, possibly several thousand years, scattered over a wide area in the northern part of the Fenno-Scandian peninsula, it is very likely that isolate phenomena with genetic drift could occur.

The population of Kautokeino is known to have an incidence of first cousin marriages of 9.3% in this century, one of the highest recorded in any population. More than 90% of the marriages in Kautokeino are endogamous according to birth-place (Torgersen, '56). These features were probably even more pronounced in earlier times, with less developed communications.

On this background it is not surprising that rather marked differences have been observed between Lapps living in different geographical locations.

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